PARK BRAKE LINKAGE

Field of the Invention

[0001] This invention relates generally to park brake systems for tractors and other vehicles, and more specifically to mechanical linkages for park brake systems.

Background of the Invention

[0002] Conventional tractors and other vehicles, including vehicles suited for off-road use, may have a park brake system which includes a manual or hand-operated lever connected through a pair of mechanical linkages to brake units on each of two wheels. Each of the two linkages may include several components that transfer forces necessary to apply and securely hold a brake on a wheel.

[0003] For example, each linkage may include one or more bell cranks, wire cable and/or rods. Each linkage for the left and right brake may duplicate one or more components.

[0004] Manufacturing costs and assembly time for linkages in park brake systems may relate, at least in part, to the number of components in the linkage. A park brake system is needed that has fewer components in the linkage, lower manufacturing cost, and reduced assembly time.

[0005] Park brake systems are serviced periodically for several reasons including or related to wear and tear. For example, cables in both linkages may need to be adjusted or tightened so that both brakes may be applied and will engage with equal pressure. This is one example of an adjustment to a park brake linkage that may be difficult and time intensive. A park brake linkage is needed that will reduce or minimize service requirements.

Summary of the Invention

[0006] A park brake linkage is provided that eliminates duplication of components, reduces manufacturing cost, and shortens assembly time. The park brake linkage also helps reduce or minimize service requirements. Fewer components are used than in conventional park brake linkages.

[0007] A single connector extends from the park brake actuation handle to left and right bell cranks on a brake cross shaft. The connector, which may be a rod, extends between the handle and an arm extending radially from a park brake bell

crank. The connector transmits pivoting movement of the handle to rotational movement of the park brake bell crank. A second arm may extend radially and laterally from the park brake bell crank, which may be used to turn a left brake bell crank and a right brake bell crank, each of which may be secured to a separate brake camshaft. Each camshaft has a cam lobe extending therefrom which, when rotated, may apply a brake to a separate wheel.

Brief Description of the Drawings

[0008] FIG. 1 is a rear perspective view of a brake system for a tractor showing a first embodiment of the park brake linkage.

[0009] FIG. 2 is an expanded rear perspective view of the park brake linkage according to the first embodiment.

[0010] FIG. 3 is an expanded front perspective view of the park brake linkage according to the first embodiment.

Description of the Preferred Embodiment

[0011] As shown in FIG. 1, brake system 100 may be in a tractor or other vehicle, including an off-road vehicle. When the park brake is operated, left and right brakes may be applied together. When brake pedals are operated, the left and right brakes may be applied independently of each other.

[0012] Park brake actuation handle 101 may be, and in normal use will be, used to apply the brakes on two wheels (i.e., the left and right wheels) of a vehicle. The park brake actuation handle may be positioned at or in the operator station of the vehicle. In one embodiment, handle 101 may be pivotably attached to mounting plate 104 secured to the body or frame.

[0013] Brake pedals 102, 103 also may be used to apply brakes independently to each of the left and right wheels. Left brake pedal 102 and right brake pedal 103 may be floor mounted or hanging in the operator station. For example, as shown in FIG. 1, the brake pedals may be floor mounted over brake pedal pivot shaft 105 which may be rotatably mounted to the tractor body or frame. Alternatively, the

brake pedals may be positioned to hang below the brake pedal pivot shaft. Stop 106 may be provided to locate both brake pedals at a rest position.

[0014] In one embodiment, one of the brake pedals may rotate with respect to the brake pedal pivot shaft, and the other brake pedal may be secured to and rotate together with the shaft. For example, left brake pedal 102 may be attached to sleeve 107 and right brake pedal 103 may be attached to sleeve 108. Sleeve 107 may rotate on the brake pedal pivot shaft, and sleeve 108 may be secured to the brake pedal pivot shaft.

[0015] In one embodiment, sleeve 107 may have radially extending arm 109. Left brake rod 110 may extend between arm 109 and left brake main bell crank 111. Left brake rod 110 may include turnbuckle 112 which may be used to change the rod length. When the left brake pedal is applied, sleeve 107 rotates on the brake pedal pivot shaft, moving left brake rod 110 longitudinally to rotate left brake main bell crank 111. The left brake main bell crank may be secured to and rotate together with left brake camshaft 113. As shown in FIG. 2, rotating the left brake camshaft urges cam lobe 115, which is on the left brake camshaft's outer circumference, against projection 116 on plate 117, and then rotates plate 117. Rotation of plate 117 will apply the left wheel brake in a conventional manner understood by those skilled in the art. Return spring 159 may urge the left brake pedal toward the rest position.

[0016] In one embodiment, left brake main bell crank 111 may fit around and be secured to left brake camshaft 113. For example, a key may engage slots in the internal diameter of the left brake main bell crank and the external diameter of the left brake camshaft. As shown in FIGS. 2 and 3, the left brake main bell crank may have a generally sleeve-shaped body with first end 118, second end 119, and arms 120, 121, and 122 extending radially from the body. Arm 120 may be connected to return spring 123, to urge the left brake main bell crank toward the rest position. Arm 121 may have slot 124 which may pivotably receive one end of left brake rod 110. Slot 124 may be dimensioned to provide a lost motion mechanism so that application of the park brake does not alter the position of the left brake foot pedal. When the park brake is applied, park brake bell crank 141 may contact arm 122 and rotate the

left brake bell crank to apply the left brake.

[0017] In one embodiment, right brake rod 125 may extend between right brake front bell crank 126 and right brake main bell crank 127. Right brake rod 125 may include turnbuckle 128 which may be used to change the rod length. When the right brake pedal is applied, brake pedal pivot shaft 105 and right brake front bell crank 126 rotate together, moving right brake rod 125 longitudinally and rotating right brake main bell crank 127. Right brake main bell crank 127 may be secured to right brake camshaft 129, both of which may be secured to brake cross shaft 114 with a key or similar device. Rotating the right brake camshaft urges cam lobe 130, which is on the right brake camshaft's outer circumference, against projection 131 on plate 132, and then rotates plate 132. Rotation of plate 132 will apply the right wheel brake in a conventional manner understood by those skilled in the art. Return spring 133 may be connected to arm 134, to urge the right brake pedal back toward the rest position.

[0018] In one embodiment, right brake main bell crank 127 may fit around and be secured to right brake camshaft 129. For example, a key may engage slots in the internal diameter of the right brake main bell crank and the external diameter of the right brake camshaft. The right brake main bell crank and the right brake camshaft may be secured to brake cross shaft 114, and may rotate together with the brake cross shaft. As shown in FIGS. 2 and 3, right brake main bell crank 127 may have a generally sleeve-shaped body with first end 135, second end 136, and arm 137 extending radially from the body. Arm 137 may have slot 138 which may pivotably receive one end of right brake rod 125. Slot 138 may be dimensioned to provide a lost motion mechanism so that application of the park brake does not alter the position of the right brake foot pedal.

[0019] Park brake actuation handle 101 may be used to apply both the left and right brakes. When the handle is pulled, it may pivot on axis 139 adjacent the first end of the handle, and move connector 140 longitudinally to rotate park brake bell crank 141. In one embodiment, connector 140 may be a rod that connects the first end of the handle to park brake bell crank 141. The connector may include turnbuckle 160 to adjust the length. Rotating the park brake bell crank rotates the left and right brake camshafts so that cam lobes 115, 130 on the outer circumference of the

camshafts abut projections 116, 131 on plates 117, 132, and then rotate the plates to apply the left and right brakes. A latch (not shown) may releasably lock the park brake actuation handle in the park brake position.

[0020] In one embodiment, park brake bell crank 141 may be dimensioned to fit around left brake camshaft 113. A bearing may be pressed into the internal diameter of the park brake bell crank. For example, the bearing may be a dry bearing made from or including an elastomeric material. As shown in FIGS. 2 and 3, park brake bell crank 141 may have a generally sleeve-shaped body, first end 142, second end 143, and arms 144, 145 extending from the body. Arm 144 extends radially from the park brake bell crank adjacent the first end. Arm 144 may include slot 146 which may pivotably receive one end of connector 140. Slot 146 may be dimensioned to provide a lost motion mechanism so that application of either or both brake pedals does not alter the position of the park brake bell crank and park brake actuation handle.

[0021] In one embodiment, as shown in FIG. 3, arm 145 may extend radially and longitudinally from the second end of park brake bell crank 141. When handle 101 is actuated and park brake bell crank 141 is rotated, arm 145 may abut and push against arm 122 extending radially from left brake main bell crank 111 and arm 147 extending radially from right brake secondary bell crank 148. Arm 145 may push against arms 122 and 147 sufficiently to turn the left brake main bell crank and right brake secondary bell crank, rotating the left and right brake camshafts to apply the left and right brakes.

[0022] In one embodiment, adjustment device 149 may set the relative position of park brake bell crank 141 with respect to left brake main bell crank 111 and right brake secondary bell crank 148. The adjustment device may be used to equally distribute force from the park brake actuation handle to the left and right brakes. For example, the adjustment device may be an externally threaded member that may engage an internally threaded passage in arm 145, and a nut to lock the externally threaded member in a desired position. The position of the park brake bell crank with respect to each of arms 122, 147 then may be adjusted as needed.

[0023] Right brake secondary bell crank 148 may have an internal diameter

dimensioned to fit around brake cross shaft 114, and may be secured to the brake cross shaft. For example, roll pin 150 may be inserted through corresponding holes in the right brake secondary bell crank and brake cross shaft. The right brake secondary bell crank may have a generally sleeve-shaped body with first end 151, second end 152, and arms 147, 153 extending from the body. When the park brake bell crank is rotated, arm 145 (acting through adjustment device 149 extending from arm 145) may abut and push against arm 147 which extends radially and longitudinally from the right brake secondary bell crank, rotating the right brake secondary bell crank and right brake camshaft to apply the right brake. Arm 153 may extend radially from the right brake secondary bell crank and be connected to return spring 154, for urging the right brake secondary bell crank toward the rest position.

[0024] In one embodiment, left brake camshaft 113 and right brake camshaft 129 may be generally sleeve-shaped members having internal diameters dimensioned to fit over brake cross shaft 114. Left brake camshaft 113 may extend through park brake bell crank 141 and left brake main bell crank 111. Left brake camshaft 113 may terminate at or adjacent second end 119 of left brake main bell crank 111, so that it is spaced from first end 155 of the brake cross shaft. Right brake camshaft may extend through right brake main bell crank 127. Right brake camshaft may terminate at or near second end 156 of the brake cross shaft. Left brake camshaft 113 may rotate on brake cross shaft 114, and right brake camshaft 129 may be secured to brake cross shaft 114. For example, roll pin 157 may be inserted through corresponding holes in the right brake camshaft and brake cross shaft.

[0025] One or more lock rings may be positioned and locked on camshafts 113 and/or 129 to locate and maintain their axial positions with respect to a transmission and/or one or more other components. For example, lock rings may be placed between left brake bell crank 111 and right brake secondary bell crank 148.

[0026] The park brake linkage described above significantly reduce the number of components compared to conventional park brake systems. Instead of a pair of linkages, a single linkage connects the park brake actuation handle and a left and a right bell crank on a brake cross shaft. As a result, manufacturing costs may be

reduced and assembly time may be lower than with conventional park brake systems.

[0027] Having described the preferred embodiment, it will become apparent that various modifications can be made without departing from the scope of the invention as defined in the accompanying claims.